

Ecological site R058BY104WY Clayey (Cy) 10-14" PZ

Accessed: 07/09/2020

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

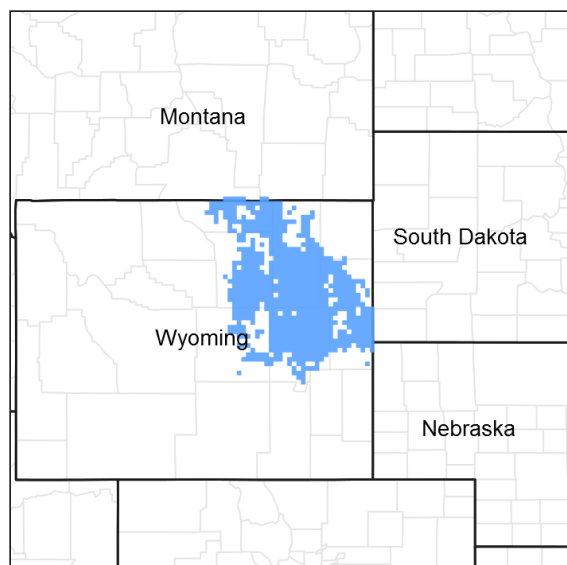


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 058B—Northern Rolling High Plains, Southern Part

MLRA 58B—Northern Rolling High Plains, Southern Part is located in northeastern Wyoming (95 percent) and extreme southeastern Montana (5 percent). It is comprised of sedimentary plains, scoria hills, and river valleys. The major rivers are the Powder, Tongue, Belle Fourche, Cheyenne, and North Platte. Other tributaries include the Little Powder River, Little Missouri River, Clear and Crazy Woman Creeks, and others. This MLRA is traversed by Interstates 25 and 90, and U.S. Highways 14 and 16. The extent of MLRA 58B covers approximately 12.3 million acres. Major land uses include rangeland (approximately 93 percent), and cropland, pasture and hayland (approximately 2 percent), while forest, urban, and miscellaneous land occupy the remainder (approximately 5 percent). Cities include Buffalo, Casper, Sheridan, and Gillette, WY. Land ownership is mostly private. Federal lands include Thunder Basin National Grassland (U.S. Forest Service), and Bureau of Land Management properties. Areas of interest in MLRA 58B in Wyoming include Fort Phil Kearny State Historic Site, Glendo State Park, and Lake DeSmet.

The elevations in MLRA 58B increase gradually from north to south and range from approximately 2,900 to 5,900 feet. A few buttes are higher than 6,800 feet. The average annual precipitation in this area ranges from 10-17 inches per year. Precipitation occurs mostly during the growing season, often during rapidly developing thunderstorms. Mean

annual air temperature is 46°F. Summer temperatures may exceed 100°F. Winter temperatures may drop to subzero, and snowfall averages 45 inches per year, but varies from 25 to over 70 inches in some locales.

Classification relationships

USDA Natural Resources Conservation Service (NRCS):

Land Resource Region— G Western Great Plains Range and Irrigation; Major Land Resource Area (MLRA)— 58B Northern Rolling High Plains, Southern Part (USDA, 2006).

Relationship to Other Classifications:

USDA Forest Service (FS) Classification Hierarchy:

Province—331 Great Plains-Palouse Dry Steppe; Section—331G-Powder River Basin; Subsections— 331Gb Montana Shale Plains, 331Ge Powder River Basin, 331Gf South Powder River Basin-Scoria Hills (Cleland et al, 1997)

Environmental Protection Agency (EPA) Classification Hierarchy:

Level III Ecoregion—43 Northwestern Great Plains; Level IV Ecoregion— 43p Scoria Hills, 43q Mesic-Dissected Plains, 43w Powder River Basin (EPA, 2013)

<https://www.epa.gov/eco-research/ecoregions>

REVISION NOTES:

The Clayey (Cy) 10-14" PZ site was developed by an earlier version of the Clayey (Cy) 10-14" Precipitation Zone ESD (2001, updated 2005). The earlier version of the Clayey ESD were based on input from NRCS (formerly Soil Conservation Service) and historical information obtained from the Clayey 10-14 Northern Plains (NP) and Clayey 15-17 NP Range Site Descriptions (1988). This ESD meets the Provisional requirements of the National Ecological Site Handbook (NESH). This ESD will continue refinement towards an Approved status according to the NESH.

Ecological site concept

The Clayey 10-14" PZ site occurs on nearly level to gentle slopes on sedimentary plains or uplands. It is a cool-season dominant, mixed-grass prairie (bunch- and rhizomatous midgrasses), secondary warm-season shortgrasses; with a lesser component of forbs and shrubs.

Associated sites

R058BY150WY	Sandy (Sy) 10-14" PZ Sandy 10-14
R058BY158WY	Shallow Clayey (SwCy) 10-14" PZ Shallow Clayey
R058BY122WY	Loamy (Ly) 10-14" PZ Loamy 10-14
R058BY128WY	Lowland (LL) 10-14" PZ Lowland

Similar sites

R058BY204WY	Clayey (Cy) 15-17" PZ More production than Clayey 10-14
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> (2) <i>Krascheninnikovia lanata</i>
Herbaceous	(1) <i>Pascopyrum smithii</i> (2) <i>Nassella viridula</i>

Physiographic features

This site occurs on nearly level to gently sloping fans, ridges, and on footslopes or backslopes of hills, on sedimentary plains or uplands.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Fan remnant (3) Ridge (4) Hill
Runoff class	Medium to very high
Flooding frequency	None
Ponding frequency	None
Elevation	2,500–5,100 ft
Slope	0–15%
Water table depth	80 in
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation ranges from 10 to 17 inches per year across MLRA 58B. There are two Precipitation Zones (PZs). The 10-14" PZ is predominant across the MLRA, including portions of Sheridan, Johnson, and Natrona Counties; portions of Campbell and Converse Counties; and smaller portions of Weston and Niobrara Counties. The 15-17" PZ occurs in northern and eastern portions of the MLRA, including portions of Sheridan, Campbell, and western Crook Counties. Wide fluctuations in precipitation may occur from year to year, and occasional periods of extended drought (longer than one year in duration) can be expected. Two-thirds of the annual precipitation occurs during the growing season from May through September. Mean Annual Air Temperature (MAAT) is 46°F. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may also occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring. High-intensity afternoon thunderstorms may arise in summer. Annual wind speed averages about 5 mph, ranging from 6 mph during the winter and spring. Daytime winds generally are stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 75 mph. The average length of the freeze-free period (28°F) is 125 days from May 16 to September 19. The average frost-free period (32°F) is 101 days from June 1 to September 9, area-wide.

Growth of native cool-season plants begins in late April to early May with peak growth in mid- to late June. Native warm-season plants begin growth in late May to early June and continue into August. Regrowth of cool-season plants occurs in September in most years, depending upon moisture.

Note: The climate described here is based on historic climate station data and is averaged to provide an overview of annual precipitation, temperatures, and growing season. Future climate is beyond the scope of this document. However, research to determine the effects of elevated CO₂ and/or heating on mixed-grass prairie ecosystems, and how it may relate to future plant communities, is ongoing.

For detailed information, or to find a specific climate station, visit the Western Regional Climate Center (WRCC) website: Western Regional Climate Center, Historical Data, Western U.S. Climate summaries, NOAA Coop Stations, Wyoming (Note: Montana climate stations are also listed under the Wyoming link).
<https://wrcc.dri.edu/summary/Climsmwy.html>

Wind speed averages can be found at the WRCC home page, under the Specialty Climate tab: <https://wrcc.dri.edu/>

The following tables represent climate area-wide, 10-14 inches PZ:

Table 3. Representative climatic features

Frost-free period (characteristic range)	92-103 days
Freeze-free period (characteristic range)	121-128 days
Precipitation total (characteristic range)	12-13 in
Frost-free period (actual range)	86-107 days
Freeze-free period (actual range)	116-129 days
Precipitation total (actual range)	11-14 in
Frost-free period (average)	98 days
Freeze-free period (average)	124 days
Precipitation total (average)	13 in

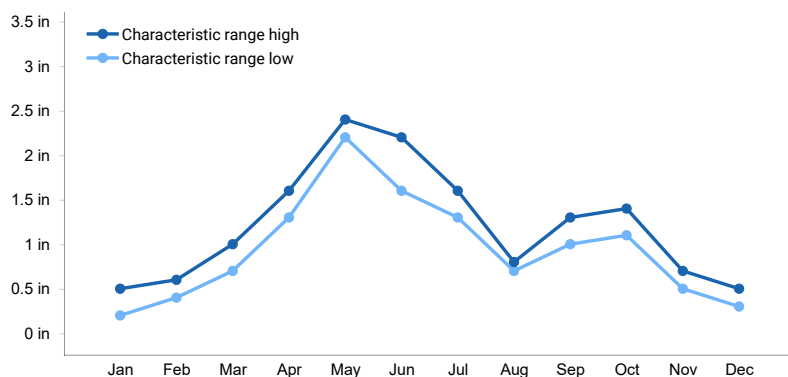


Figure 2. Monthly precipitation range

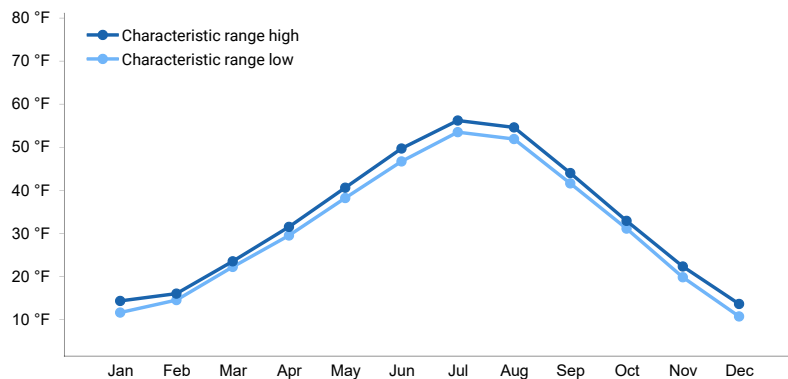


Figure 3. Monthly minimum temperature range

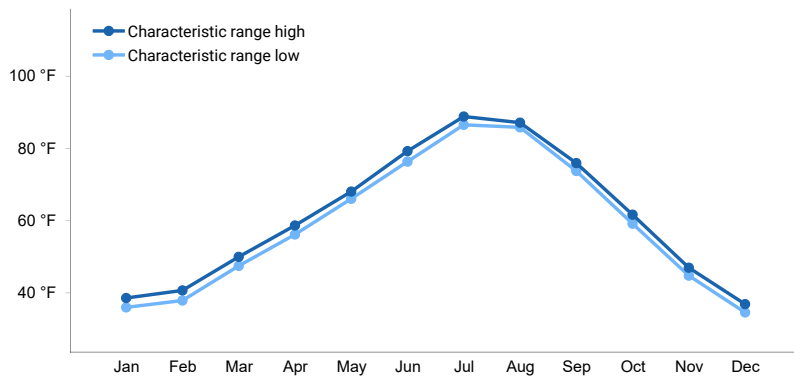


Figure 4. Monthly maximum temperature range

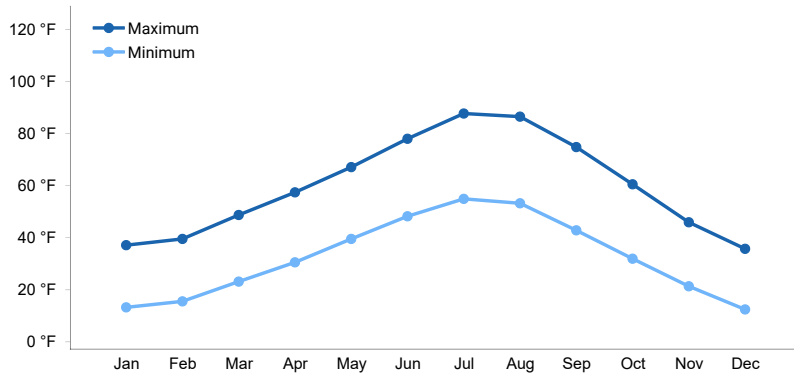


Figure 5. Monthly average minimum and maximum temperature

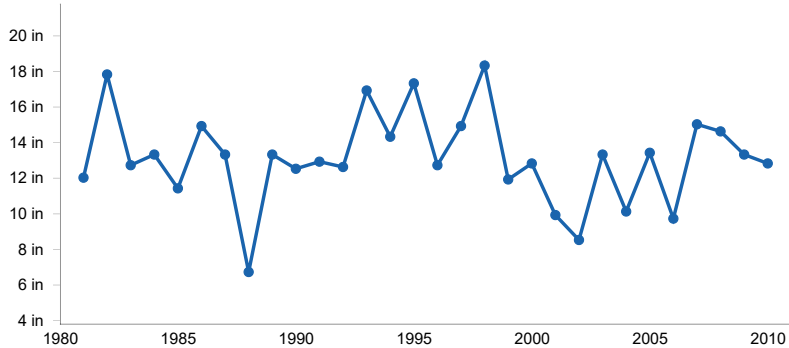


Figure 6. Annual precipitation pattern

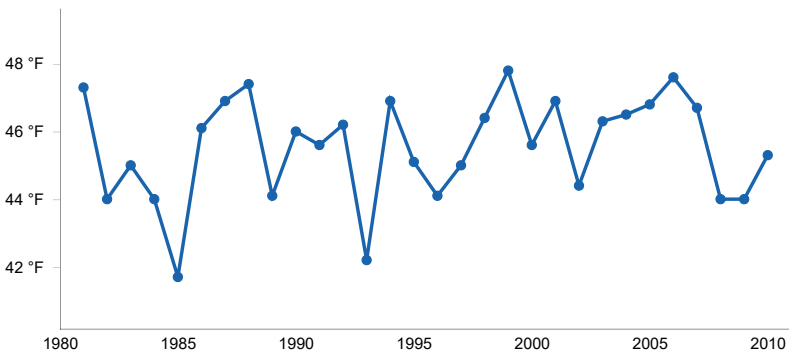


Figure 7. Annual average temperature pattern

Climate stations used

- (1) DULL CTR 1SE [USC00482725], Douglas, WY
- (2) GLENROCK 5 ESE [USC00483950], Glenrock, WY
- (3) KAYCEE [USC00485055], Kaycee, WY
- (4) MIDWEST [USC00486195], Midwest, WY
- (5) SHERIDAN CO AP [USW00024029], Sheridan, WY
- (6) WESTON 1 E [USC00489580], Weston, WY
- (7) BUFFALO [USC00481165], Buffalo, WY
- (8) CASPER NATRONA CO AP [USW00024089], Casper, WY
- (9) WRIGHT 12W [USC00489805], Gillette, WY

Influencing water features

There are no water features of the ecological site or adjacent wetland/riparian regimes that influence the vegetation and/or management of the Clayey 10-14" PZ ecological site.

Soil features

The soils on this site are typically deep to very deep, but includes moderately deep, well drained soils that formed from alluvium or slope alluvium; moderately deep soils formed from residuum derived from shale. They typically have a slow to moderately slow permeability class. The available water capacity is typically moderate but ranges from low to high. Available water is the portion of water in a soil that can be readily absorbed by plant roots. This is the amount of water released between the field capacity and the permanent wilting point. As the fineness of the texture increases, there is a general increase in available moisture storage from sands to loams and silt loams. The soil moisture regime is typically ustic aridic. The soil temperature regime is mesic.

The surface layer of the soils in this site are typically clay loam, silty clay loam, silty clay, or clay, but may include loam. The surface layer ranges from a depth of 1 to 10 inches thick. The subsoil is typically silty clay, clay, silty clay loam, or clay loam. Soils in this site typically have carbonates at the surface; but a few soils may be leached to 33 inches. These soils are susceptible to erosion by water and wind. The potential for water erosion accelerates with increasing slope.

Surface soil structure is very fine to fine granular, and structure below the surface is prismatic and/or angular or subangular blocky. Soil structure describes the manner in which soil particles are aggregated and defines the nature of the system of pores and channels in a soil. Together, soil texture and structure help to determine the ability of the soil to hold and conduct the water and air necessary for sustaining life.

Major soil series correlated to this ecological site include: Renohill, Silhouette, Savageton, Ulm, Wags, and Wyarno.

The attributes listed below represent 0-40 inches in depth or to the first restrictive layer.

Note: Revisions to soil surveys are on-going. For the most recent updates, visit the Web Soil Survey, the official site for soils information: <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Residuum–shale
Surface texture	(1) Clay loam (2) Silty clay loam (3) Silty clay (4) Clay
Drainage class	Well drained
Permeability class	Slow to moderately slow
Soil depth	40–80 in

Available water capacity (Depth not specified)	5.2–8.4 in
Calcium carbonate equivalent (Depth not specified)	0–10%
Electrical conductivity (Depth not specified)	0–4 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0–5
Soil reaction (1:1 water) (Depth not specified)	6.6–8.5
Subsurface fragment volume <=3" (Depth not specified)	0–5%

Table 5. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Soil depth	20–80 in
Available water capacity (Depth not specified)	Not specified
Calcium carbonate equivalent (Depth not specified)	Not specified
Electrical conductivity (Depth not specified)	Not specified
Sodium adsorption ratio (Depth not specified)	Not specified
Soil reaction (1:1 water) (Depth not specified)	Not specified
Subsurface fragment volume <=3" (Depth not specified)	Not specified

Ecological dynamics

The information in this ESD, including the state-and-transition model diagram (STM), was developed using archeological and historical data, professional experience, and scientific studies. The information is representative of a dynamic set of plant communities that represent the complex interaction of several ecological processes. The plant composition has been determined by study of rangeland relic areas, areas protected from excessive disturbance, seasonal use pastures, short duration, time-controlled grazing strategies, and historical accounts.

The Clayey 10-14" PZ ecological site is characterized by five states: Reference, Sod-Bound, Native Disturbed, Invaded, and Tilled. The Reference State is characterized by cool-season rhizomatous midgrass (western wheatgrass), cool-season bunch midgrass (green needlegrass), and warm-season shortgrass (blue grama). Other grasses and grass-like include thickspike wheatgrass, prairie Junegrass, threadleaf sedge, Sandberg bluegrass, and bluebunch wheatgrass. A secondary component of forbs, and shrubs (big sagebrush) are also present. The Sod-bound State is characterized by warm-season shortgrass (blue grama and/or buffalograss) and grass-like (threadleaf sedge). The Native Disturbed State is characterized by rhizomatous wheatgrasses, green needlegrass, blue grama; forbs (curlycup gumweed, hairy false goldenaster, and annuals), and shrubs (broom snakeweed, fringed sagewort, and pricklypear). Invasives include cool-season annual bromes such as field brome (also known as Japanese brome), and cheatgrass. The Invaded State is characterized by annual grasses and forbs, threeawn, prickly pear, and bare ground. The Tilled State is characterized by "Go-back" plant community which includes threeawn, crested wheatgrass, annual grasses

and forbs, field brome, cheatgrass and other invasive species, and bare ground.

The degree of grazing has a significant impact on the ecological dynamics of the site. This region was historically occupied by large grazing animals such as bison and elk, along with pronghorn and mule deer. Grazing by these large herbivores, along with climatic fluctuations, had a major influence on the ecological dynamics of this site. Deer and pronghorn are widely distributed throughout the MLRA. Secondary influences of herbivory by species such as small rodents, insects, and root-feeding organisms has impacted the vegetation and continues today.

Recurrent drought has historically impacted the vegetation of this region. Changes in species composition and production will vary depending upon the duration and severity of the drought cycle, and on prior grazing management.

As this site begins to shift from a combination of frequent and severe defoliation during the growing season, bunchgrasses such as needle and thread will decrease in both frequency and production. Grasses such as blue grama, threadleaf sedge, and sixweeks fescue will increase. Forbs and shrubs such as hairy false goldenaster, tansyaster, broom snakeweed, and fringed sagewort, will also increase. If continued, the plant community will become sod-bound, and all midgrasses can eventually be removed from the plant community. Over the long-term, this continuous use in combination with high stocking rates, will result in bare ground developing, and species such as pricklypear, broom snakeweed, and annual forbs such as wooly plantain, field cottonrose, and alyssum, and pepperweed increasing or invading.

The following diagram illustrates the common plant communities that can occur on the site and the community pathways (CP) among plant communities. Plant Communities are identified by 1.1, 1.2 etc., and are described in the narrative. Bold lines surrounding each state represent ecological thresholds. Transitions (T) indicate the transition across an ecological threshold to another state. Once a threshold has been crossed into another state, it may not be feasible to return to the original state, even with significant management inputs and practices. The ecological processes plant communities, community pathways, transition and/or restoration pathways will be discussed in more detail in the plant community descriptions following the diagram.

State and transition model

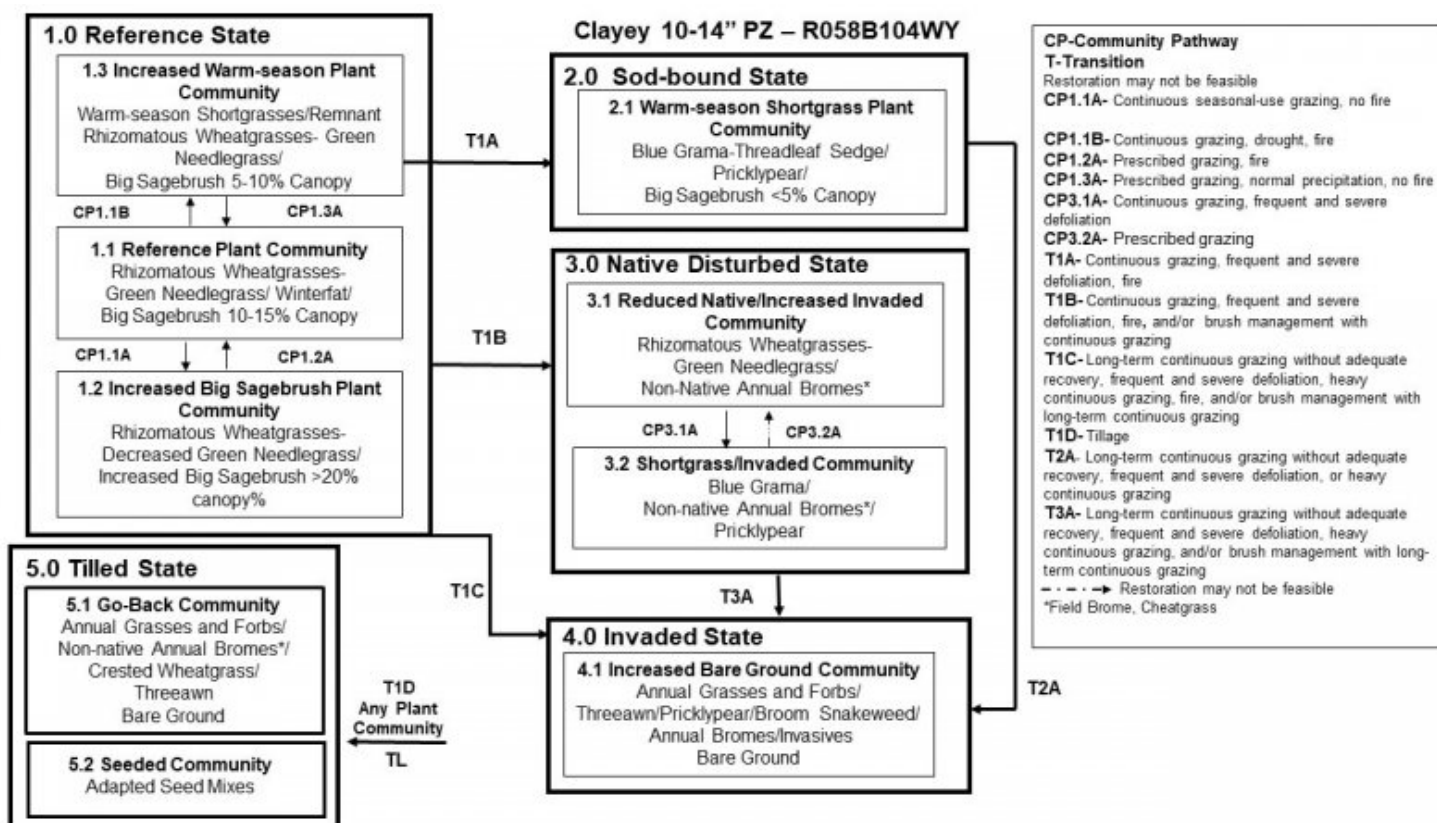


Figure 8.

State 1

Reference State

The Reference State is characterized by three distinct plant community phases: Reference, Increased Big Sagebrush, and Increased Warm-Season Plant Communities. The plant communities, and various successional stages between them, represent the natural range of variability within the Reference State.

Community 1.1

1.1 Reference Plant Community— Rhizomatous Wheatgrasses, Green Needlegrass, Big Sagebrush 10-15 Percent Canopy

This is the interpretive plant community for this site. It is well adapted to the Northern Great Plains climate. This community developed with grazing by large herbivores and is suited to grazing by domestic livestock. Historically, fires likely were patchy and randomly distributed. This plant community can be found on areas where grazed plants receive adequate periods of recovery during the growing season. The potential vegetation is about 75 percent grasses and grass-like, 5-10 percent forbs, and 5-15 percent woody plants.

The plant community consists predominantly of cool-season midgrasses, with a smaller component of warm-season shortgrasses. The major grasses/grass-like include western wheatgrass and green needlegrass. Secondary grasses include thickspike wheatgrass, prairie Junegrass, threadleaf sedge, Sandberg bluegrass, needle and thread, bluebunch wheatgrass, and blue grama. A variety of forbs include American vetch, white and purple prairieclover, slimflower scurfpea, large Indian breadroot, and prairie coneflower. Primary shrubs are big sagebrush and winterfat (see the Species Composition List for additional information.) Plant diversity is high.

In the 10 to 14" Precipitation Zone (PZ), the total annual production (air-dry weight) is about 1,100 pounds per acre during an average year, but it can range from about 600 pounds per acre in unfavorable years to about 1,400 pounds per acre in above-average years. Defoliation levels should be determined as part of a grazing management plan based on objectives.

Nutrient and water cycles, and energy flow are functioning properly. Infiltration rates are moderate, and soil erosion is low. Litter is properly distributed where vegetative cover is continuous. Decadence and natural plant mortality are low. This community is resistant to many disturbances except excessive grazing, tillage, or development into urban or other uses.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	445	852	1060
Forb	50	110	170
Shrub/Vine	105	138	170
Total	600	1100	1400

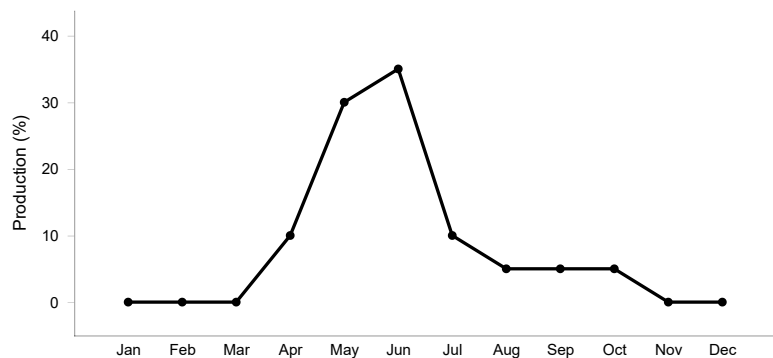


Figure 10. Plant community growth curve (percent production by month). WY1401, 10-14NP upland sites.

Community 1.2

1.2 Increased Big Sagebrush Plant Community— Rhizomatous Wheatgrasses, Decreased Green Needlegrass, Increased Big Sagebrush Greater Than 20 Percent Canopy

This plant community developed with excessive grazing without adequate recovery opportunity during the growing season. Green needlegrass may initially increase or decrease depending on the season of grazing use. Palatable forbs such as white and purple prairieclover, American vetch, and penstemon are present in reduced amounts. White sagebrush (cudweed sagewort), hairy false goldenaster, slimflower scurfpea, large Indian breadroot, scarlet globemallow, broom snakeweed and fringed sagewort, have increased. Big sagebrush canopy has also increased. Natural disturbances such as lack of fire can contribute to this shift.

In the 10 to 14" PZ, the total annual production (air-dry weight) is about 900 pounds per acre during an average year, but it can range from about 600 pounds per acre in unfavorable years to about 1,200 pounds per acre in above-average years.

Total aboveground biomass has been reduced. Reduction of rhizomatous wheatgrasses, nitrogen-fixing forbs, and increased warm-season shortgrasses have begun to alter the biotic integrity of this community. Water and nutrient cycles may be impaired.

Nearly all plant species typically found in the Reference Plant Community are present and will respond to changes in grazing management.

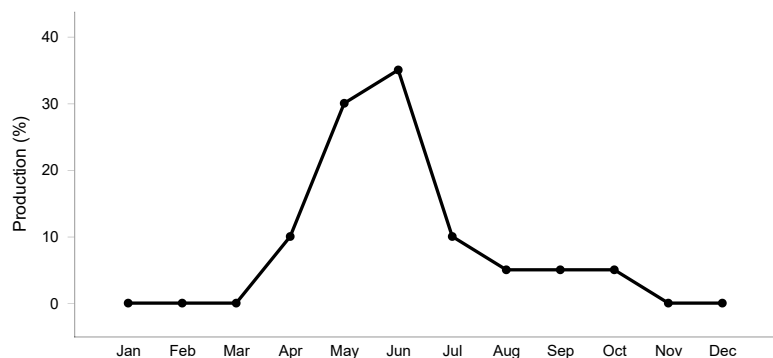


Figure 11. Plant community growth curve (percent production by month). WY1401, 10-14NP upland sites.

Community 1.3

1.3 Increased Warm-Season Plant Community— Decreased Cool-Season Midgrasses, Increased Warm-Season Shortgrasses, Big Sagebrush 5-10 Percent Canopy

This plant community developed with excessive grazing without adequate recovery opportunity during the growing season. Grazing-tolerant species such as blue grama and threadleaf sedge have noticeably increased. Green needlegrass may initially increase or decrease depending on the season of grazing use. Palatable forbs such as white and purple prairieclover, American vetch, and penstemon are present in reduced amounts. Hairy false goldenaster, slimflower scurfpea, scarlet globemallow, fringed sagewort, and broom snakeweed have increased. Big sagebrush canopy may be reduced by fire. Natural disturbances such as fire and drought can contribute to this shift.

In the 10 to 14" PZ, the total annual production (air-dry weight) is about 800 pounds per acre during an average year, but it can range from about 500 pounds per acre in unfavorable years to about 1,100 pounds per acre in above-average years.

Total aboveground biomass has been reduced. Reduction of rhizomatous wheatgrasses, nitrogen-fixing forbs, and increased warm-season shortgrasses have begun to alter the biotic integrity of this community. Water and nutrient cycles may be impaired.

Nearly all plant species typically found in the Reference Plant Community are present and will respond to changes in grazing management.

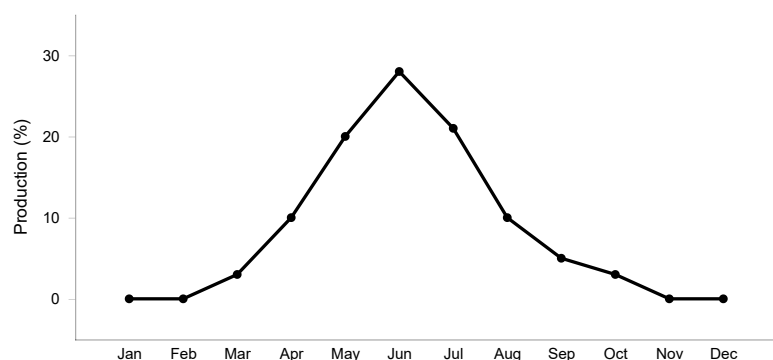


Figure 12. Plant community growth curve (percent production by month). WY5803, Northern Rolling High Plains, Southern Part, cool-season/warm-season co-dominant. Cool-season/warm-season co-dominant.

Pathway 1.1A Community 1.1 to 1.2

Excessive grazing without adequate recovery between grazing events, drought, or lack of fire, can shift this plant community toward the Increased Big Sagebrush Plant Community. Over a period of years, plant species less tolerant to frequent and severe defoliation will begin to decrease, and those more tolerant will begin to increase. Continuous seasonal-use grazing, from year-to-year (i.e. spring grazing only) will result in a loss of cool-season species. Conversely, summer use only will result in a reduction of warm-season species. Biotic integrity and water and nutrient cycles may become impaired because of this community pathway.

Pathway 1.1B Community 1.1 to 1.3

Excessive grazing without adequate recovery between grazing events, drought, or fire can shift this plant community toward the Increased Warm-Season Plant Community. Over a period of years, plant species less tolerant to frequent and severe defoliation will begin to decrease, and those more tolerant will begin to increase. Excessive grazing from year-to-year will result in a reduction or loss of cool-season species. Biotic integrity and water and nutrient cycles may become impaired because of this community pathway.

Pathway 1.2A Community 1.2 to 1.1

Grazing that allows for adequate recovery between grazing events, along with proper stocking rates, will shift the Increased Big Sagebrush Plant Community back toward the Reference Plant Community. Natural disturbances such as return to normal precipitation fire will contribute to this shift.

Management actions may include the reduction of big sagebrush to appropriate levels of canopy cover together with prescribed grazing and proper stocking. Brush management by chemical treatment of big sagebrush is an option. Precaution and care should be taken when using this treatment method. The residual ecosystem properties, such as seed source, species composition, nutrient and hydrologic cycles, greatly influence the rate and probability of successful restoration. NOTE: Brush management alone will not restore this site and is only supplemental to prescribed grazing for this restoration pathway. Recommendations include a consultation and field evaluation prior to undertaking restoration activities. This restoration activity requires more field investigation and documentation.

Pathway 1.3A

Community 1.3 to 1.1

Grazing that allows for adequate recovery between grazing events, and proper stocking rates, will shift the Increased Warm-Season Plant Community back toward the Reference Plant Community. Natural disturbances such as return to normal precipitation patterns or no fire will contribute to this shift.

State 2

Sod-bound State

This state is characterized by the Warm-Season Shortgrass Plant Community. An ecological threshold has been crossed and a significant amount of production and diversity has been lost when compared to the Reference State. Significant biotic and soil changes have negatively impacted energy flow and the nutrient and hydrologic cycles.

This is a very stable state, resistant to change due to the high tolerance of blue grama and/or buffalograss to grazing, the development of a shallow root system (or root pan), and subsequent changes in hydrology and nutrient cycling. The loss of other functional/structural groups such as cool-season bunch and rhizomatous grasses, forbs, and shrubs, reduces the biodiversity and productivity of this site.

Community 2.1

2.1 Warm-Season Shortgrass Plant Community— Blue Grama, Threadleaf Sedge, Pricklypear, Big Sagebrush Greater Than 5 Percent Canopy

This plant community develops under long-term frequent and severe defoliation. This typically occurs when the community has been continuously grazed with heavy stocking rates, throughout the growing season over a period of many years. The midgrasses and palatable forbs have been eliminated. The dominant species are blue grama, threadleaf sedge, and/or buffalograss. These species have developed into a sod-bound condition occurring in localized colonies exhibiting a mosaic appearance. Perennial threeawn species such as Fendler's threeawn have increased. Forbs such as scarlet globemallow, wild onion, death camas, and slimflower scurfpea remain. Forbs and shrubs that continue to increase are Cuman ragweed (western ragweed), hairy false goldenaster, fringed sagewort, and pricklypear. Plant diversity is low.

Energy flow, water cycle and mineral cycle have been negatively affected. Litter levels are very low and unevenly distributed.

In the 10 to 14" PZ, the total annual production (air-dry weight) is about 650 pounds per acre during an average year, but it can range from about 400 pounds per acre in unfavorable years to about 900 pounds per acre in above-average years.

This plant community is extremely resistant to change. Many plant species are missing a seed source is not readily available.

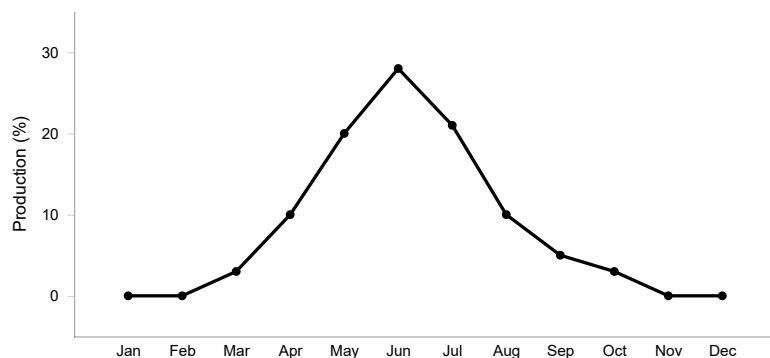


Figure 13. Plant community growth curve (percent production by month). WY5803, Northern Rolling High Plains, Southern Part, cool-season/warm-season co-dominant. Cool-season/warm-season co-dominant.

State 3 Native Disturbed State

The Native Disturbed State develops with heavy, excessive grazing and/or excessive defoliation, and/or brush management followed by excessive grazing. An ecological threshold has been crossed. Erosion and loss of organic matter and carbon reserves are resource concerns.

Community 3.1

3.1 Reduced Native/Increased Invaded Plant Community— Rhizomatous Wheatgrasses, Green Needlegrass, Non-Native Annual Bromes

This plant community developed with frequent and severe defoliation without adequate recovery periods during the growing season, fire, and/or brush management followed by excessive grazing. Grazing-tolerant species such as blue grama and threadleaf sedge have noticeably increased. Green needlegrass, prairie Junegrass, and Sandberg bluegrass may initially increase or decrease depending upon the season of grazing use. The increased bare ground allows for the invasion of non-native annual cool-season grasses such as field brome (also known as Japanese brome) and cheatgrass to invade.

In the 10 to 14" PZ, the total annual production (air-dry weight) is about 500 pounds per acre during an average year, but it can range from about 350 pounds per acre in unfavorable years to about 650 pounds per acre in above-average years.

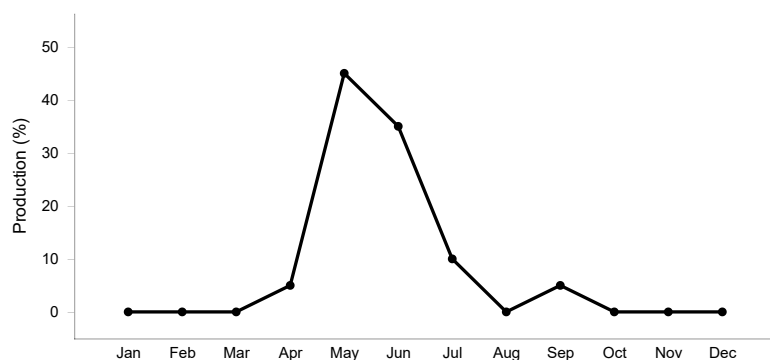


Figure 14. Plant community growth curve (percent production by month). WY1301, 15-19NP Upland sites.

Community 3.2

3.2 Shortgrass/Invaded Plant Community— Blue Grama, Remnant Wheatgrasses, Non-native Annual Bromes, Pricklypear

This plant community develops under long-term excessive grazing or frequent and severe defoliation without adequate recovery. The midgrasses and palatable forbs have been eliminated. Grazing-tolerant species such as blue grama and threadleaf sedge are prevalent. The increased bare ground allows for an increase in sixweeks fescue and the invasion of annual cool-season grasses such as field brome (Japanese brome) and cheatgrass. Forbs and shrubs that continue to increase are Cuman ragweed (western ragweed), hairy false goldenaster, fringed sagewort, and pricklypear. Plant diversity is very low.

In the 10 to 14" PZ, the total annual production (air-dry weight) is about 400 pounds per acre during an average year, but it can range from about 275 pounds per acre in unfavorable years to about 525 pounds per acre in above-average years.

Energy flow and the water and mineral cycles have been negatively affected. Litter levels are very low and unevenly distributed.

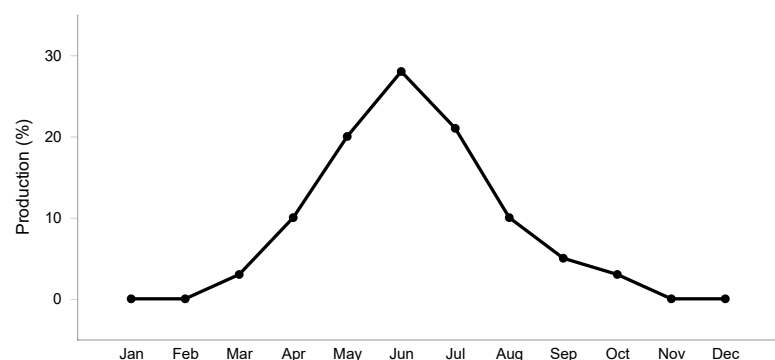


Figure 15. Plant community growth curve (percent production by month). WY5803, Northern Rolling High Plains, Southern Part, cool-season/warm-season co-dominant. Cool-season/warm-season co-dominant.

Pathway 3.1A Community 3.1 to 3.2

Excessive grazing or frequent and severe defoliation, without adequate recovery between grazing events, can shift this plant community toward the Shortgrass/Invaded Plant Community. Over a period of years, plant species less tolerant to frequent and severe defoliation will begin to decrease, and those more tolerant will begin to increase. Bare ground will continue to increase, allowing for the invasion of non-native species. Biotic integrity and water and nutrient cycles may become impaired because of this community pathway.

Pathway 3.2A Community 3.2 to 3.1

Grazing that allows for adequate recovery between grazing events, along with proper stocking rates, will shift the Shortgrass/Invaded Plant Community back toward the Reduced Native/Increased Invaded Plant Community. Restoration may not be feasible, depending upon the amount of remnant wheatgrasses in the stand or the amount of non-native perennial species that have moved into the site.

State 4 Invaded State

Long-term excessive grazing or frequent and severe defoliation, without adequate recovery between grazing events, heavy, excessive grazing with overstocking, or brush management followed by long-term excessive grazing will cause a shift across an ecological threshold to the Invaded State.

An ecological threshold has been crossed. The hazard of soil erosion from the increased bare ground, and loss of organic matter or carbon reserves, along with the invasion of exotic species are resource concerns.

Community 4.1

4.1 Increased Bare Ground Community— Annual Grasses and Forbs, Threeawn, Pricklypear, Invasives, and Bare Ground

This plant community occurs where the rangeland is grazed year-round, at high stock densities. Physical impact such as trampling, soil compaction, and trailing typically contribute to this transition. The plant composition is made of annuals with a few species of perennial forbs and grasses that are very tolerant to frequent and severe defoliation. Grasses include Fendler's threeawn. Annuals such as sixweeks fescue, Russian thistle, and kochia have increased or invaded. The dominant forbs include hairy false goldenaster, curlycup gumweed, field cottonrose, woolly plantain, and alysium species. Green sagewort, broom snakeweed, and pricklypear are increasing.

In the 10 to 14" PZ, the total annual production (air-dry weight) is about 400 pounds per acre during an average year, but it can range from about 275 pounds per acre in unfavorable years to about 525 pounds per acre in above-average years.

Soil erosion hazard has increased due to the increase of bare ground. Runoff typically is high and infiltration is low. All ecological functions are impaired. Desertification is advanced.

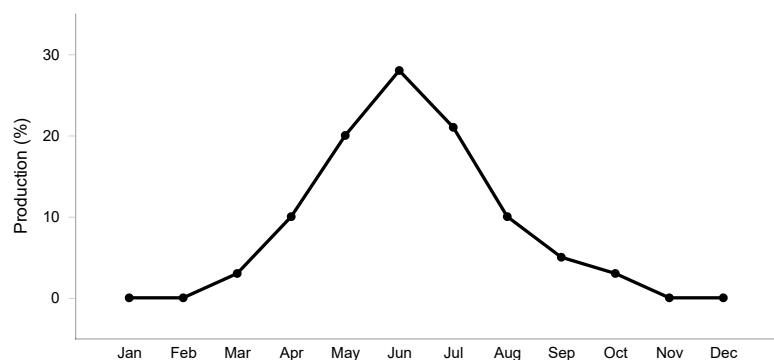


Figure 16. Plant community growth curve (percent production by month). WY5803, Northern Rolling High Plains, Southern Part, cool-season/warm-season co-dominant. Cool-season/warm-season co-dominant.

State 5

Tilled State

The Tilled State is the result of the site mechanical farming operations. An ecological threshold has been crossed due to complete removal of vegetation and years of soil tillage. Physical, chemical, and biological soil properties have been dramatically altered. There is no restorative pathway known at this time. This state includes Go-Back and Seeded Communities.

Community 5.1

Go-Back Community— Annual Grasses and Forbs, Non-Native Annual Bromes, Crested Wheatgrass, Threeawn, and Bare Ground

Go-back land is created when the soil is tilled or farmed (sodbusted) and abandoned. All the native plants are destroyed, soil organic matter is reduced, soil structure is changed, and a plowpan or compacted layer is formed. Residual synthetic chemicals often remain from past farming operations, and erosion processes may be active.

Go-back land evolves through several plant communities beginning with an early annual plant community, which initiates the revegetation process. Plants such as Russian thistle, kochia, and other annuals begin to establish. Annual bromes such as field brome (also known as Japanese brome), and cheatgrass invade. These plants give some protection from erosion and start to build minor levels of soil organic matter. This early annual plant community lasts for two to several years. Purple threeawn, and several other early perennials can dominate the plant community for five to

eight years or more. Non-native cool-season grasses such as crested wheatgrass may invade, if a seed source is available. Buffalograss establishes next and dominates for many years. Eventually western wheatgrass, blue grama, and other natives become reestablished. Where go-back land has eroded to parent material, the slow process of soil development and reestablishment of vegetation will start. This is a very slow process (100 years or more). A new ecological site may evolve, depending upon severity of soil and parent material erosion and parent material.

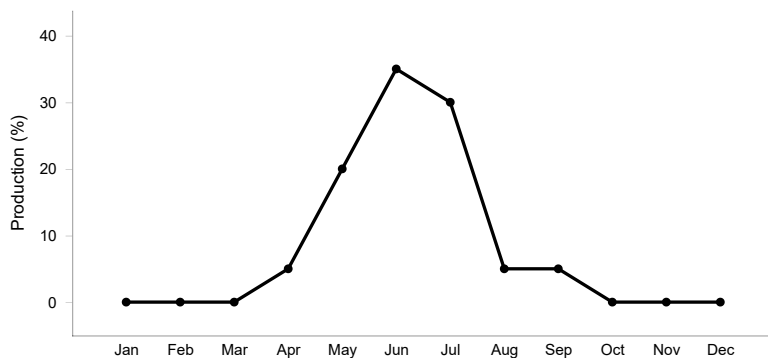


Figure 17. Plant community growth curve (percent production by month). WY1104, 12-14SP upland sites w/ warm. 12-14" Precipitation Zone, Southern Plains (SP) with warm-season (grass) species.

Community 5.2

5.2 Seeded Community— Adapted Seed Mixes

This plant community can vary considerably depending upon the degree of soil erosion, the species seeded, stand establishment, and the age and management of the stand.

This plant community is represented by applying the conservation practice of Rangeland Seeding on go-back land or recently cropped land for converting it to permanent vegetative cover. Plant species indigenous to the site are used throughout the MLRA due to their suitability to the semi-arid climate. Indigenous species are most adapted to site conditions and therefore can be sustained in the MLRA. Improved cultivars (named varieties) of plant species are typically used to enhance seedling establishment and meet specific reclamation resource objectives.

Transition T1A

State 1 to 2

Excessive grazing without adequate recovery between grazing events or frequent and severe defoliation, if continued, will shift this plant community across an ecological threshold toward the Sod-Bound State. Biotic integrity and hydrologic function will be impaired because of this transition.

Transition T1B

State 1 to 3

Excessive grazing or frequent and severe defoliation, without adequate recovery periods following each grazing event, or brush management followed by excessive grazing, will shift this plant community across an ecological threshold toward the Native Disturbed State. Erosion and loss of organic matter or carbon reserves are concerns. Annual grasses such as sixweeks fescue may increase. Non-native annual bromes begin to invade in this transition.

Transition T1C

State 1 to 4

Long-term excessive grazing or frequent and severe defoliation without adequate recovery between grazing events, heavy, excessive grazing with overstocking, or brush management followed by long-term excessive grazing will cause a shift across an ecological threshold to the Invaded State.

Transition T1D**State 1 to 5**

Mechanical tillage of this ecological site will cause an immediate transition across an ecological threshold to the Tilled State. This transition can occur from any plant community and is irreversible.

Transition T2A**State 2 to 4**

Long-term excessive grazing or frequent and severe defoliation without adequate recovery between grazing events, or heavy, excessive grazing with overstocking, will cause a shift across an ecological threshold to the Invaded State.

Transition T2B**State 2 to 5**

Mechanical tillage of this ecological site will cause an immediate transition across an ecological threshold to the Tilled State. This transition can occur from any plant community and is irreversible.

Transition T3A**State 3 to 4**

Long-term excessive grazing or frequent and severe defoliation without adequate recovery between grazing events, heavy, excessive grazing with overstocking, or brush management followed by long-term excessive grazing will cause a shift across an ecological threshold to the Invaded State.

Transition T3B**State 3 to 5**

Mechanical tillage of this ecological site will cause an immediate transition across an ecological threshold to the Tilled State. This transition can occur from any plant community and is irreversible.

Transition T4A**State 4 to 5**

Mechanical tillage of this ecological site will cause an immediate transition across an ecological threshold to the Tilled State. This transition can occur from any plant community and is irreversible.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Rhizomatous Wheatgrasses			330–550	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	330–440	–
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus ssp. lanceolatus</i>	165–330	–
2	Cool-Season Mid-bunch			275–385	
	green needlegrass	NAVI4	<i>Nassella viridula</i>	275–385	–
	Cusick's bluegrass	POCU3	<i>Poa cusickii</i>	55–110	–
3	Warm-Season Mid=short			55–110	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	55–110	–
4	Miscellaneous			22–110	

	Grass, perennial	2GP	<i>Grass, perennial</i>	19–95	–
	plains reedgrass	CAMO	<i>Calamagrostis montanensis</i>	11–55	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	11–55	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	11–55	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	11–55	–
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	11–55	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	11–55	–
Forb					
5	Forbs			55–165	
	American vetch	VIAM	<i>Vicia americana</i>	11–55	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	11–55	–
	aster	ASTER	<i>Aster</i>	11–55	–
	desertparsley	LOMAT	<i>Lomatium</i>	11–55	–
	large Indian breadroot	PEES	<i>Pedimelum esculentum</i>	11–55	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	11–55	–
	rosy pussytoes	ANRO2	<i>Antennaria rosea</i>	11–55	–
	milkvetch	ASTRA	<i>Astragalus</i>	11–55	–
	stemless mock goldenweed	STAC	<i>Stenotus acaulis</i>	11–55	–
	sulphur-flower buckwheat	ERUM	<i>Eriogonum umbellatum</i>	11–55	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	11–55	–
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	11–55	–
	white prairie clover	DACA7	<i>Dalea candida</i>	11–55	–
	bluebells	MERTE	<i>Mertensia</i>	11–55	–
	textile onion	ALTE	<i>Allium textile</i>	11–55	–
	tapertip hawksbeard	CRAC2	<i>Crepis acuminata</i>	11–55	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	11–55	–
Shrub/Vine					
6	Shrubs			110–165	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>	55–110	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	11–55	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	11–55	–

Animal community

Wildlife Interpretations (from 2001 ESD, will be revised in future updates).

Rhizomatous Wheatgrasses, Green needlegrass Community : The predominance of grasses in this plant community favors grazers and mixed-feeders, such as bison, elk, and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants. However, topographical variations could provide some escape cover. When found adjacent to sagebrush dominated states, this plant community may provide brood rearing and foraging areas for sage grouse, as well as lek sites. Other birds that would frequent this plant community include Western meadowlarks, horned larks, and golden eagles. Many grassland-obligate small mammals would occur here.

Heavy Sagebrush Plant Community: This plant community can provide important winter foraging for elk, mule deer and antelope, as sagebrush can approach 15 percent protein and 40-60 percent digestibility during that time. This community provides excellent escape and thermal cover for large ungulates, as well as nesting and brood rearing habitat for sage grouse.

Greasewood/ wheatgrass plant community: This plant community exhibits a low level of plant species diversity due to the accumulation of salts in the soil. It may provide some thermal and escape cover for deer and antelope if no other woody community is nearby, but in most cases it is not a desirable plant community to select as a wildlife habitat management objective.

Mixed Sagebrush/Grass Plant Community: The combination of an overstory of sagebrush and an understory of grasses and forbs provides a very diverse plant community for wildlife. The crowns of sagebrush tend to break up hard crusted snow on winter ranges, so mule deer and antelope may use this state for foraging and cover year-round, as would cottontail and jack rabbits. It provides important winter, nesting, brood-rearing, and foraging habitat for sage grouse. Brewer's sparrows nest in big sagebrush plants, and a host of other nesting birds utilize stands in the 20-30 percent cover range.

Blue Grama Sod Plant Community : These communities provide limited foraging for antelope and other grazers. They may be used as a foraging site by sage grouse if proximal to woody cover and if the Historic Climax Plant Community or the Western Wheatgrass/Cheatgrass Plant Community are limiting. Generally, these are not target plant communities for wildlife habitat management.

Go-back Land: These communities provide limited foraging for antelope and other grazers. They may be used as a foraging site by sage grouse if proximal to woody cover and if the Historic Climax Plant Community or the Western Wheatgrass/Cheatgrass Plant Community are limiting. Generally, these are not target plant communities for wildlife habitat management.

Introduced Pasture: These communities are highly variable depending on the species planted. Refer to Forage Suitability Groups for more information.

Animal Community – Grazing Interpretations (updated April 2019)

The following table is a guide to stocking rates for the plant communities described in the Clayey 10-14" PZ site. These are conservative estimates for initial planning. On-site conditions will vary, and stocking rates should be adjusted based on range inventories, animal kind and class, forage availability (adjusted for slope and distance to water), and the type of grazing system (number of pastures, planned moves, etc.), all of which is determined in the conservation planning process.

The following stocking rates are based on the total annual forage production in a normal year multiplied by 25 percent harvest efficiency of preferred and desirable forage species, divided by 912 pounds of ingested air-dry vegetation for an animal unit per month (Natl. Range and Pasture Handbook, 1997). An animal unit month is defined as the amount of forage required by one livestock animal, with or without one calf, for one month, and is shortened to AUM.

Plant Community (PC) Production (total lbs./acre in a normal year) and Stocking Rate (AUM/acre) are listed below:

Example: Reference PC – (1100) (.30)

1,100 lbs. per acre X 25% Harvest Efficiency = 275 lbs. forage demand for one month. 275 lbs. per acre/912 demand per AUM = .30

10-14 Inch PZ:

Reference PC - (1100) (0.30)

Increased Big Sagebrush PC - (900) (0.25)

Increased Warm-Season PC – (800) (0.22)

Sod-Bound PC - (650) (0.18)

Reduced Native/Increased Invaded PC (*) (*)

Shortgrass/Invaded PC (*) (*)

Increased Bare Ground PC (*) (*)

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangelands in this area provide year-long forage under prescribed grazing for cattle, sheep, horses, and other herbivores. During the dormant period, livestock may need supplementation based on reliable forage analysis.

Hydrological functions

(Hydrology section from 2001 ESD. It will be revised in future updates).

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group C, with localized areas in hydrologic group D. Infiltration ranges from slow to moderately slow. Runoff potential for this site varies from moderate to high depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where short-grasses form a strong sod and dominate the site. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Part 630, NRCS National Engineering Handbook for detailed hydrologic information).

Rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Cryptogamic crusts are present, but only cover 1-2 percent of the soil surface.

Recreational uses

This site provides hunting opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an esthetic value that appeals to visitors.

Wood products

No appreciable wood products are present on the site.

Other products

None noted.

Other information

Site Development & Testing Plan

General Data (MLRA and Revision Notes, Hierarchical Classification, Ecological Site Concept, Physiographic, Climate, and Water Features, and Soils Data):

Updated. All "Required" items complete to Provisional level.

Community Phase Data (Ecological Dynamics, STM, Transition & Recovery Pathways, Reference Plant Community, Species Composition List, Annual Production Table):

Updated. All "Required" items complete to Provisional level.

Annual Production Table is from the "Previously Approved" ESD (2001).

The Species Composition List is from the "Previously Approved" ESD (2001).

The Annual Production Table and Species Composition List must be reviewed for future updates at the Approved level.

Each Alternative State/Community:

Complete to Provisional level.

Supporting Information (Site Interpretations, Assoc. & Similar Sites, Inventory Data References, Agency/State Correlation, References)

Updated. All "Required" items complete to Provisional level.

Wildlife Interpretations: Narrative is from "Previously Approved" ESD (2001). Wildlife species must be updated at the next Approved level.

Livestock Interpretations: Plant community names and stocking rates updated.

Hydrology, Recreational Uses, Wood Products, and Other Products carried over from previously "Approved" ESD (2001).

Existing NRI Inventory Data References updated.

Reference Sheet:

Rangeland Health Reference Sheet carried over from previously "Approved" ESD (2005). It will be updated at the next "Approved" level.

"Future work, as described in a project plan, to validate the information in this provisional ecological site description is needed. This will include field activities to collect low and medium intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document." (NI 430_306 ESI and ESD, April 2015)

Inventory data references

Information presented here has been derived from data collection on private and federal lands using:

- Double Sampling*
- Rangeland Health**
- Soil Stability**
- Line Point Intercept : Foliar canopy, basal cover (Forb, Graminoid, Shrub, Subshrub, Lichen, Moss, Rock fragments, bare ground, % Litter)***
- Soil pedon descriptions collected on site****

*NRCS 528-Prescribed Grazing Standard job sheets.

**Interpreting Indicators of Rangeland Health, Version 4, 2005

***Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems, Volume II, 2005

***Field Book for Describing and Sampling Soils, Version 3, 2012

NRI- Natural Resource Inventory data

SCS-RANGE-417 Production & Composition Record for Native Grazing Lands

Additional reconnaissance data collection using numerous ocular estimates and other inventory data; NRCS clipping data for USDA program support; Field observations from experienced range trained personnel.

Data Source: NRI

Number of Records: 32

Sample Period: 2004-2015

State: WY

Counties: Campbell, Converse, Crook, Johnson, Natrona, Niobrara, Sheridan, Weston

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Data collection for this ecological site was done in conjunction with the progressive soil surveys within the 58B Northern Rolling High Plains (Southern Part), of Wyoming and Montana.

Note: Revisions to soil surveys are on-going. For the most recent updates, visit the Web Soil Survey, the official site for soils information: <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	04/01/2005
Approved by	E. Bainter
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills should not be present.

2. **Presence of water flow patterns:** Barely observable.

3. **Number and height of erosional pedestals or terracettes:** Essentially non-existent.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is 20-30% occurring in small areas throughout site.

5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None

7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Plant cover and litter is at 70% or greater of soil surface and maintains soil surface integrity. Soil Stability class is anticipated to be 5 or greater.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use Soil Series description for depth and color of A-horizon.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Grass canopy and basal cover should reduce raindrop impact and slow overland flow providing increased time for infiltration to occur. Healthy deep rooted native grasses enhance infiltration and reduce runoff. Infiltration is Slow.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer or soil surface crusting should be present.

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

Dominant: Mid-stature Cool Season Rhizomatous Grasses = Mid-stature Cool
Season Bunch Grasses Short-stature Warm Season Grasses Forbs Shrubs

Sub-dominant:

Other:

Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very Low

14. **Average percent litter cover (%) and depth (in):** Average litter cover is 25-35% with depths of 0.25 to 1.0 inches.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1,100 lbs./ac.

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Blue grama, Curlycup Gumweed, Fringed sagewort, Prickly Pear, Broom Snakeweed, and Species found on Noxious Weed List.

17. **Perennial plant reproductive capability:** All species are capable of reproducing.
